Intermountain Generating Station

Boiler Over-Fire Air (OFA) Installation Project

Part 1: Description & Control Outline

Description of the Overfire Air (OFA) System and Control Devices.

The over-fire air (OFA) system at the Intermountain Generating Station (IGS) is being provided by Babcock Power, Inc. (BPI). It consists of two rows of OFA ports located on the elevation immediately above the top burner levels on both the front (south) and rear (north) sides of the boiler. Each row consists of eight, identical, OFA ports with one port located over each of the six burner columns (column ports) and one port located on each end of the OFA rows near the side walls of the boiler (wing ports).

Air to the OFA system is provided by the Secondary Air (SA) system. A feeder duct extends from each SA header duct to the corresponding OFA header through which secondary air is admitted to the OFA headers. Each OFA feeder duct includes isolation dampers operated by Jordan rotary electrical drives.

OFA airflow to the boiler is admitted and controlled through the OFA port dampers. Each OFA port is partitioned into separate 1/3 and 2/3 sections. Airflow, through each partition, is controlled by port dampers located in each partition. The four, 1/3 port dampers for an OFA row half are connected or ganged together for simultaneous operation by a Jordan rotary electrical drive. The same configuration is implemented for the 2/3 port damper sets. This creates a total of four, 1/3 port dampers/drives and four, 2/3 port dampers/drives for air flow control to the boiler.

Control and monitoring of all OFA damper drives will be done by the IGS combustion control system. Additionally, an array of three Air Monitor Corporation VOLU-probes and thermocouples will measure OFA mass flow through each of the feeder ducts.

Description of the Proposed Control Strategy.

Note: All boiler load setpoint values and the OFA secondary air ratio setpoint curve, described below, are initial values. These values will be revised based on the results of the commissioning performance tests. Please refer to documentation to be provided by BPI.

OFA is most effective controlling NOx formation at unit loads above 60% of the rated load of 950 MW. When utilized at the 60% load point and above, OFA flow will be accomplished by the combination of opening OFA feeder and port dampers and decreasing the combustion air damper positions, so as to maintain target total SA flow based on unit load.

The OFA port and feeder duct dampers are not modulating and will be operated either fully open or fully closed (except for biasing of the open position to achieve balanced O2 distribution across the burner front). SA airflow to the OFA system is attained by simultaneously decreasing the openings of all the combustion air dampers feeding each of the burner elevations that are in operation. This decrease is to be superimposed on the existing automatic control biasing of each elevation combustion air in accordance with pulverizer loading.

This SA damper control is additive to the existing bias required to change burner airflow in proportion to the individual pulverizer load. The action of the sum of both biases will result in less secondary air directly to the burners, as OFA is being introduced, but the relative secondary air distribution between burner elevations will remain unchanged.

BPI will provide a setpoint curve showing the desired ratio of OFA flow to secondary airflow as a function of boiler load. These values will be confirmed or revised based upon actual tests.

The OFA port relative open area sizes, 1/3 and 2/3, are calculated to provide the correct velocity of the OFA to attain the proper penetration of the OFA into the combustion region of the furnace above the burners. All ports of a given kind, 1/3 or 2/3, will open or close following a program designed to open the correct area to roughly produce the proper penetration velocity as the OFA air flow rate changes with boiler load. The initial program is as follows:

0 to 60% boiler load:	All 1/3 and 2/3 ports closed
60 to 75% boiler load:	1/3 ports open, 2/3 ports closed
75 to 90% boiler load:	1/3 ports closed, 2/3 ports open
90 to 100% boiler load:	1/3 ports open, 2/3 ports open

An individual manual/automatic and bias station per port group damper drive will be provided.

Part 2: Target Operating Parameters for OFA Design

The OFA modifications shall provide for a continuous boiler rating of 6,900,000 lbs/hr output at 1005°F superheat and 1005°F reheat temperature under normal operating conditions. These modifications shall include the design, fabrication and installation on both IGS Units 1 & 2 for an overfire air system capable of providing a reduction in NOx emissions of 15% and consistent NOx emissions of less than 0.40 lbs/MMBTU under all operating modes.

Of particular interest to IPSC are the performance parameters associated with operation at 950 Megawatts gross generation (6.75 MMlbs/hr steam flow). These include:

a. Total NOx output of 0.40 lbs/MMBTU or less and an overall reduction of 15%. Current maximum average of 0.45 lbs/MMBTU.

b. Superheat and reheat temperatures as well as NOx emissions must remain within the contract stated acceptable ranges throughout the test.

c. Impact on average unburned carbon (LOIs) and carbon monoxide (CO) concentrations within the boiler.

d. The above operational parameters shall be verified in a steady state operational test within 30 days of installation. Steady state operation shall be defined as stable and reliable operation at and within the following operating conditions and ranges for a period of at least 7 days:

- 7 pulverizers in service (E and G Pulverizers alternately out-of-service).
- Excess air to be controlled between 2.5 to 3.2%.
- Superheat and convection surfaces maintained at 80-85% cleanliness
- Boiler tube maximum allowable metal temperatures must not be exceeded.
- Turbine throttle pressure of 2375 psi.
- Furnace cleanliness maintained at 85-90% actual cleanliness.
- Superheat attemperator spray flow at or above 50,000lbs/hr
- Reheat attemperator spray flow at 0 lbs/hr

NOTE: These are target parameters only for purposes of OFA design and performance evaluation, and in no way are intended to limit boiler operation in any way.

Part 3: Good Combustion Practice

Since fuel utilization and combustion efficiency suffer in attempts to minimize NOx generation in the boiler, CO can rise due to incomplete or poor combustion. There are no add-on controls specific to CO technologically, nor are they commercially available in any form for utility steam generators. As a matter of practice, BACT for CO is considered to be Good Combustion Practice.

Good combustion practice (GCP) is defined as system design, operation, and maintenance techniques which can increase combustion efficiency. The GCP control strategy includes collectively applying a number of combustion conditions to achieve three broad goals:

(1) Maximize fuel utilization and boiler efficiency;

(2) Minimize byproducts of poor combustion (CO) and

(3) Minimize creation of combustion related pollutants (NOx).

The emphasis in an effective good combustion practice lies in the design of the combustion system. There are several specific measurable parameters that compose a set of combustion indicators that can be related directly or indirectly to the design of the GCP components. These combustion parameters are:

-CO levels in the flue gas;

-Loss of Ignition in ash;

-NOx levels in the flue gas

-Excess O2 in the combustion air; and

-Heat Rate (i.e., plant efficiency - heat input vs. load production).

Good combustion is essentially a balance of the GCP components, which by the nature of the combustion process, are antagonistic. High fuel utilization and boiler performance increases NOx creation. Minimizing NOx through combustion controls increases CO and LOI, and decreases efficiency. GCP design balances these effects to optimize each component. CO is a good indicator of combustion efficiency, which when measured before and after modifications to a combustion process, can verify GCP design.

The ability to maintain low CO and NOx concentrations in flue gases is dependent on combustion design features such as those found in retrofit OFA ports. Once the design has been demonstrated to be GCP, GCP is further employed in operating and maintenance practices. Since CO is minimized as an inherent component to maximizing efficiency and lowering operating costs, there exists a natural incentive towards GCP in OFA operation and maintenance. GCP therefore can be demonstrated through review of data presently being collected.

Part 4: Permitting

IPSC proposes that to verify GCP in the OFA design, the GCP components discussed above be measured during both a pre-OFA installation test and a post OFA installation test. CO results will be reported to the Utah DAQ accordingly to confirm GCP. The other parameters will be checked for quality assurance and performance of the tests. Once GCP has been confirmed in the design of the OFA with the pre- and post-OFA installation tests, IPSC proposes to maintain for inspection certain records of operating and maintenance data to reflect continuing GCP utilizing data sources presently and readily available.

IPSC has requested that the DAQ provide Approval to construct the OFA modifications as described above and in our Notice of Intent. Upon demonstrating GCP and verifying NOx reduction and CO values after installation, IPSC requests that DAQ make a determination that the installation of over-fire air ports is a environmentally beneficial pollution control project. In doing so, DAQ can affirm that the OFA project does not fall under PSD requirements, and therefore no new limits, operating conditions, or reporting requirements are required to be imposed.